Can evolutionary mismatch help generate interest in health promotion messages?

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Abstract

Background: Generating interest in health interventions is an important first step towards engagement with health promotion and effecting behaviour change. This study explored whether framing health information about physical activity and diet from an evolutionary mismatch perspective could help to generate interest in health promotion among overweight and inactive adults. Evolutionary mismatch theory proposes that human cultural evolution has occurred too rapidly for biological evolution to keep up, creating a mismatch between genes and lifestyles that gives rise to chronic diseases such as type 2 diabetes.
Method: Eighteen adults completed interviews in which they viewed and discussed a variety of mismatch-framed health information resources. Follow-up questions assessed if and what participants had thought about the information in the week after the interview. Transcripts were thematically analysed.
Results: Participants found the evolutionary perspective to be novel and interesting. It also provided a meaningful rationale for behaviour change. However, there was some evidence of negative elaboration, which would need to be managed if implementing this approach.
Conclusion: Using a mismatch perspective can help to engage audiences with important health information.

Keywords
Health communication, health promotion, physical activity, diet, evolutionary mismatch theory

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Introduction

Individual lifestyle change is recognised in many national public health policies as an important means of reversing the rising trends of obesity and associated chronic diseases, such as type 2 diabetes (Leeman et al., 2012; Butland et al., 2007). Self-directed interventions are increasingly being explored by health services as a way of bringing about individual lifestyle change on a large scale while reducing costs (Tang et al., 2016). These interventions involve little or no contact with professionals, instead requiring users to instigate changes by themselves, and are often delivered through Internet or mobile phone use. However, attrition rates are often high (Tang et al., 2014). For example, in a trial by Lim and colleagues (2014) only 22% of participants completed an Internet-delivered self-directed intervention to promote weight loss and maintenance among young women.

Crutzen and colleagues have proposed that one way to prevent attrition is to stimulate greater interest among users in the intervention (Crutzen and Ruiter, 2015). Experimental research has demonstrated that interest promotes increased cognitive effort, cognitive elaboration (deeper thought) and greater persistence in tasks (Silvia et al., 2009; Thoman et al., 2011). The present study proposes that using the concept of an evolutionary mismatch to frame health information about physical activity and healthy eating might help to stimulate interest among inactive or overweight adults on the basis that it introduces novelty and a degree of complexity that invites further engagement in order to understand the link between evolution and health.

The evolutionary mismatch concept holds that genetic evolution has failed to keep pace with recent rapid changes in the human cultural environment, particularly in Western society where many everyday tasks are now done by machines and highly calorific foods are readily available. The resulting mismatch between our genes and environment leads to chronic disease as our bodies struggle to process continually high intakes of certain nutrients or remain strong in the absence of muscle- and bone-strengthening physical exertion (Leonard, 2008; Konner and Eaton, 2010). Evidence that this may be seen by the public as novel and interesting comes from the popularity of the Paleo Diet movement, which advocates consuming only foods that would have been eaten by Palaeolithic people and trying to emulate hunter-gatherer activity patterns (Cordain, 2002). While the extreme lifestyle recommendations of the Paleo Diet are not evidence-based (Warinner, 2013; Zuk, 2013), the concept of a genetic mismatch increasing our disposition to chronic disease does have supportive evidence from a range of fields (for reviews, see Konner and Eaton, 2010; Lieberman, 2013). For example, paleontological, anthropological and epidemiological studies have linked patterns of disease and disease markers to variations in lifestyles (e.g. Leonard, 2010; Lindeberg et al., 1999) and an increasing number of small clinical trials have found significant improvements in health markers, such as insulin sensitivity, among clinical and healthy samples after following diets more similar to our ancestors' (Otten et al., 2017; Frassetto et al., 2009).

Encouraging use of self-directed interventions

Government health messages about the importance of exercise and diet for controlling weight and preventing disease have remained the same for decades (Levy, 2016), and, at least in Western countries, public awareness of these messages is high (Roberts and Marvin, 2011; Thompson and Kumar, 2011). The familiarity of these messages makes them unlikely

to generate interest in an intervention since they will not be perceived as new (Silvia, 2008). The public is also confronted with a plethora of health messages from a variety of non-government sources (Wilson, 2007), which frequently appear contradictory. For example advice to limit intake of saturated fats for heart health and weight loss is in conflict with diets such as the Atkins, which advocate limiting only carbohydrates. This can lead to public confusion, scepticism and ultimately resistance to health messages (Crossley, 2002; Thompson and Kumar, 2011). Intervention designers thus also face the challenge of trying to attract people who have become fatigued with an overload of health-related information.

There is some research to show that stimulating interest in an intervention should help to promote volitional use of preventive health websites (Crutzen et al., 2013; Crutzen et al., 2014). Particularly for self-directed interventions, where users are free to choose whether or not they use intervention materials and for how long, identifying ways to increase perceptions of personal relevance and generate interest in interventions would seem to be a promising line of enquiry for intervention designers (Crutzen and Ruiter, 2015).

The evolutionary mismatch concept

Using the mismatch concept to frame health information about physical activity and diet could provide a novel 'hook' to generate interest among people fatigued with familiar health promotion messages. The mismatch concept would also add new information to the standard messages by providing an explanation of why physical inactivity and typical Western diets cause disease. For example, the concept could be used to illustrate how our enhanced capacity to store excess energy as fat tissue helps to ensure survival during periods of relative famine (Leonard, 2008; Lieberman, 2013), but in the modern Western environment predisposes us to obesity as periods of low energy intake never occur and so fat stores are never depleted. The added depth of understanding that the mismatch concept can provide could help to sustain interest and increase the likelihood of individuals continuing to engage with the intervention.

This study aimed to explore whether using the evolutionary mismatch concept as a framework for delivering health information about diet and physical activity would be acceptable to overweight and inactive adults and if, and how, it could help to generate interest in health information.

Method

Design

This exploratory pilot study investigated people's responses to text and graphic materials presenting health information framed in terms of an evolutionary mismatch. Qualitative methods were employed to gain detailed insights into a broad range of potentially important factors concerning participants' interpretations and responses (Yeo et al., 2014). Semi-structured interviews were conducted to show and discuss the materials, and participants also completed brief follow-up questions one week later. The study received ethical approval from the departmental ethics committee of the University of Bath (ref. EP 14/15 112).

Participants and recruitment

A convenience sampling approach (Braun and Clarke, 2013) was taken, targeting adults who could benefit from being more active or making changes to their diet. Adults aged 35 to 74 years who reported not being *both* highly active *and* lean were sought for the study ('highly active' = engaging in vigorous activity for >1 hour on most days of the week (FAO, 2001); 'lean' = BMI<25 plus a waist circumference of <84cm for men or 76cm for women). Advertisements for the study were placed in the local media and around the University.

Materials

Study resources

A variety of resources (graphics, expository texts and narratives) were used, to target different aspects of communication: Graphics were used to increase attention to text resources, to improve comprehension and to enhance recall of health information (Houts et al., 2006; Bol et al., 2016). Expository text was used in addition to graphics as this has been found to be more comprehensible for conveying detailed health messages than graphics alone (Byrne and Curtis, 2000; Chaiken and Eagly, 1976). Finally, narratives (i.e. stories) were written to try to personally engage readers with the health messages and to reduce any potential counter-arguing. Narratives aim to emotionally engage readers and have been shown to encourage cognitive elaboration (i.e. thinking about the message) and lead to changes in knowledge, attitudes and behaviours, consistent with the narrative's message (Murphy et al., 2011; Igartua and Vega Casanova, 2016). References to everyday objects or activities were included in the resources as stimuli that are more personally relevant are more likely to be liked, generate interest and encourage cognitive elaboration (Petty and Cacioppo, 1986; Bull et al., 2001). All the resources were checked for accuracy and inclusion of theory-based communication techniques by experts in physiology and health psychology, readability was also checked in pilot testing with non-experts. Resources were printed in colour on plain white paper at A4 (text) or A3 (graphics) size. Brief descriptions of the resources are given in Table 1.

Table 1

Interview schedule

The interview schedule was designed to address the study aim of exploring the acceptability and interest-generating potential of the mismatch framed resources by eliciting participants' initial perceptions of the resources and the further thoughts they provoked. The first sections contained questions directly related to the resources (e.g. what are the key points you took from the graphic/text?); the final section sought general comments on the use of the evolutionary mismatch concept in a health promotion context (e.g. Do you think these resources come across as different from other health messages? In what way?). A literature search guided the formation of the interview schedule and questions were refined with input from two academics with experience of intervention design and through pilot testing.

One week after the interviews, participants completed two follow-up questions,

delivered online, to ascertain whether any interest generated by the resources in the interviews was maintained over the following week. Participants indicated how often they had thought about the resources since viewing them and what information, if any, they had particularly thought about.

Procedure

To keep the interviews to a reasonable length, participants were randomised into two conditions: in the first condition, participants viewed the physical activity-related texts and graphics; in the other condition, participants viewed the diet-related resources. Interviews took place in a private office and were digitally recorded. Written consent was taken prior to the interview. All participants were first shown the four mismatch concept graphics (which aimed to generate initial interest); the order in which these were presented was alternated. Following the mismatch graphics, participants read the introductory expository text, then were shown either the physical activity- or the diet-related graphics, informational text and finally the narrative. Interview questions were asked about a resource before presenting the next one and viewing time was not limited. Field notes were taken during the interviews to record potentially relevant contextual information (e.g. reported reasons for volunteering for the study) and non-verbal expressions during the interview. One week after the interview, participants completed the follow-up questions online. Data was anonymised and stored securely in a password-protected hard-drive folder.

Analysis

Interview recordings were transcribed verbatim and transcripts uploaded, with field notes and responses to the follow-up questions, to NVivo software (v.10, QSR International PTY Ltd., 2012) for analysis. Inductive thematic analysis was conducted by the first author (EG) following the six-step process outlined by Braun and Clark (2006). The first author read the transcripts several times to become familiar with the data and note initial ideas. Then each transcript was coded to identify interesting features of the data. The initial codes were then organised into themes which were subsequently checked against the coded transcript extracts and entire data set to ensure they made sense and accurately reflected the data. This was an iterative process to refine and consolidate the themes. The final themes focused on here were selected for their alignment to the study aim. Data from the interviews, field notes and follow up questions were triangulated to increase the trustworthiness of the interpretations and, to help ensure dependability and confirmability of the study, the researcher discussed the codes and emerging themes with the second author throughout the analysis (Shenton, 2004). The final themes were discussed among the research team.

Results

Eighteen participants were recruited and completed both the interview and follow-up questions. Table 2 gives details of each participant. Interviews lasted a mean of 1 hour 40 minutes.

Table 2

In general, participants found the evolutionary mismatch concept to be an acceptable and interesting framework for delivering health information. The interest generated by the resources was also maintained over the course of the following week; all participants reported having thought about the information after the interview and the majority also reported that this had prompted them to think about making changes to their lifestyles. Findings were organised into the following themes that described aspects of the resources that enhanced or detracted from their acceptability or interest-generating potential: Novelty; Depth of understanding; Elaboration (positive and negative); and Counter-arguing.

Novelty

Although some people commented that the health messages ("eating the right things … not eating too much … moving more" (P8)) were not new, all participants perceived the evolutionary mismatch concept to be a novel way to present them. One participant mentioned that she had "read about a Paleo diet or something … but I haven't really seen any of that promoted in this way before" (P3). By presenting information in a new frame, the mismatch concept seemed to stimulate interest and prompted many people to think about the health messages in a new light:

> I was just thinking of today and how to get fit and less weight … I didn't think about the evolution trail that we have gone through and that illustrated it to me very well. (P17)

The visual comparisons between the ancestral and modern lifestyles, displayed in several of the graphics, seemed to be particularly good at depicting a "compelling" (P10) contrast and making participants think differently about the need for behaviour change:

> I think putting the contrast between, for example, the amount of sugary food that we had, and now suddenly, in literally the space of a few generations, it's so completely contrasting, I just think it helps you to understand some of the background of why. (P5)

Responses to the follow-up questions indicated that the impression of there being a stark contrast between modern and ancestral lifestyles stayed with many participants in the intervening week.

Interviews highlighted that the mismatch concept provided a non-blaming approach which was also perceived to be novel and attractive, particularly in relation to the information on evolved taste preferences and fat storage:

> What I've hooked on to throughout this is it's not about blame, it's about understanding, and knowing where that's come from, and the reasons for it (P2)

The mismatch frame also increased novelty by incorporating specific facts or details that people had not heard before:

> I had no idea that we couldn't digest milk 10,000 years ago, I wasn't aware of that but that's a very interesting fact. (P10)

The facts that were novel to participants tended to be recalled over the week following the interview.

Although all participants acknowledged the evolutionary aspect was novel, when asked how the resources fitted with their prior knowledge, many participants responded that it was not new information. It seemed that because participants were already aware of some details in the resources, novel details were easily accepted.

Depth of understanding

By showing how and in what environments humans have evolved, participants reported that the resources gave a deeper appreciation of "why we are what we are, why we do what we do" (P2). This was not only interesting to participants but was also considered to give powerful support to the health messages, which in turn provided a stronger rationale for making behaviour changes:

> I think they explain why movement is so important in more detail, because it's not just talking about move around more to lose weight … it's explaining that the human body is designed to be moving a lot in order for it to function properly (P13)

Some participants explicitly highlighted that a deeper understanding would give them a greater impetus to act:

> I'm somebody who really likes to understand something to be motivated as to why I need to do anything differently (P15)

The perceived depth of understanding, brought by the evolutionary aspect, was felt by some to give the resources a scientific credibility, also strengthening the argument for making changes:

> It puts more depth into it all. We're not just saying it, here's the facts and figures from hundreds of thousands of years ago (P16)

Thus it seemed that the extra information (i.e. in addition to the standard health messages) included to provide the evolutionary aspect, helped to make the resources more interesting and credible, despite placing a greater burden on participants in terms of reading time and cognitive effort required. Furthermore, there were indications that this may help to change attitudes towards behaviour change.

Elaboration

The mismatch concept led some participants to reflect on the changes they had seen in their own lives or to compare their lives with older relatives':

> When I was at school … people would have a big breakfast, a big lunch… tea in the afternoon… dinner … And people weren't fat then. I used to walk to school, I used to play – there were no such things as computers or anything (P8)

Reflecting on recognisable events from one's own life helped to heighten the sense of personal relevance of the resources and seemed to help people see the need for change.

The narratives were particularly effective at evoking personal reflections, either because participants could themselves relate to the characters or because the characters were similar to people they knew. The changes made by the characters were perceived to be credible and achievable, which seemed to enhance some participants' self-efficacy (i.e. their belief in their ability to perform a certain task):

> It made me feel those are quite small things he's done, but perhaps I could do small things in a similar way. (P12)

The resources also prompted some negative elaboration. The introductory text gave the ability to digest milk beyond infancy (i.e. lactose retention into adulthood) as an illustration of one of the few occasions of rapid evolution in humans. However, this caused a few participants to question whether they should be consuming dairy products, which was not a message the resources intended to give:

> P13: Maybe I should think about whether I should be having dairy … I know it does say that our systems have evolved to cope with it, but I wonder … would I be better off without it? Would I notice any benefit?

Counter-arguing

Several people acknowledged that life expectancy is greater today than it has ever been before, and while in most cases this was not seen as negating the mismatch message, it did cause a couple of people to question the idea of using ancestral lifestyles as a guide for modern day and to conclude "how good [the] modern lifestyle is" (P10):

> We are eating more sugar nowadays than we were back along, but then again … you hear on the news nowadays that we're living longer than we used to. Well, we used to do this, we used to have this much sugar, so what's wrong? (P16)

A more common form of counter-arguing stemmed from examples of highly processed foods used to illustrate the modern lifestyle in some of the resources. Many participants responded that these were not typical of their diet and for some this led to a feeling that they were already healthy and therefore might not feel a need to change. To a lesser extent the same pattern of counter-arguing also occurred for physical activity, with a few participants reporting a belief that their activity levels could not or did not need to be improved. However, as the interviews went on and participants viewed more resources, they seemed to reconsider and admitted that their lifestyles could be improved:

> I am a healthy eater, I do all my cooking … we don't buy any processed food, so it's all fresh. [pause] However, there are things (laughs) like chocolate and

> whatever (laughs) that just are there and they're delicious and you think 'oh sod it' (P11)

Another instance of counter-arguing occurred for a diabetic participant, P14, who had quite a substantial knowledge of his condition and felt that the resources gave "the implication … that it's exclusively lifestyle choice and that's not necessarily the case". P14 wanted to see "the genetic component of type 2 diabetes" discussed in more detail. Another of the diabetic participants, P6, felt the resources didn't explain individual differences and wanted to see more "evidence":

> I don't see how I verify that the evolutionary sweet-tooth causes diabetes, and indeed it's clearly not the whole story, because I have diabetes and you haven't. (P6)

Discussion

This study explored whether using evolutionary mismatch as a framework for delivering health information about diet and physical activity would be acceptable to and help generate interest among overweight and inactive adults. So far as we are aware, this is the first study to investigate using the mismatch concept in health education resources. The mismatch concept framework was acceptable to participants, and seemed to generate interest by way of its novelty, the greater depth of understanding it provided, and the way it prompted participants to reflect on changes in their own lifestyles. However, potential unintended responses to the mismatch concept were also highlighted: the interest generated was not always in the intended direction and there was some counter-arguing.

The perceived novelty and detail of the mismatch concept seemed to help both generate and maintain participants' interest throughout viewing the resources. These findings seem to support Silvia's (2008; 2006) appraisal theory of interest, in which interest is proposed to be generated via two sequential appraisals. The first appraisal is of the stimulus' novelty-complexity; the second appraisal is of its comprehensibility. For something to be interesting it must first be perceived as novel and have sufficient complexity to not be immediately obvious yet not be too complex to process. This will focus further attention on the stimulus to allow secondary appraisal to occur, and interest will result if the stimulus is then perceived to be within an individual's coping potential (i.e. having the skills and resources to understand the stimulus; Silvia, 2008). In the current study the mismatch framed resources were perceived as novel and participants seemed to be able to understand them, implying that the resources were within their coping potential.

The mismatch concept contained certain elements that were familiar to participants, which seemed to aid acceptance of the information. Acceptance is known to be important for increasing the likelihood of information being stored in memory and influencing attitude and behaviour change (Petty and Cacioppo, 1986; McGuire, 1999). Although simple acceptance of a message might indicate that little cognitive elaboration had occurred, which would likely lead to less stable attitude change (Petty and Cacioppo, 1986), the feelings of interest generated by the resources are likely to encourage increased cognitive effort and elaboration (Silvia, 2009; Thoman et al., 2011). Viewing humans' recent history also encouraged people to reflect on their own past, promoting a feeling of personal relevance, which may have further encouraged cognitive elaboration (Petty et al., 1987).

Another potential benefit of using the mismatch concept was the greater depth of understanding that participants felt it provided. The explanations of why certain behaviours are harmful and why humans are prone to behave in certain ways seemed to give participants a strong rationale for health behaviour change. From a theoretical perspective, providing a meaningful rationale for taking action has been proposed as an important factor for supporting an individual's autonomous motivation towards the target behaviour (Deci et al., 1994; Ryan and Deci, 2000). Further research could explore the motivational impact of mismatch concept-framed health information.

The negative elaboration and counter-arguing voiced by some participants could lead people to reject health information delivered using the evolutionary mismatch framework or to adopt unintended behaviours (Byrne and Niederdeppe, 2011). However, no participants in the current study concluded that the modern lifestyle is desirable, even if they did evaluate it favourably in terms of life expectancy and morbidity. The contrast between hunter-gatherer and modern lifestyles, highlighted in some of the graphics, seemed to be particularly good at generating interest and being remembered after the interviews. This is important since recall of information is an important predictor of health-related behaviours (Bol et al., 2016). Future research could investigate whether and how recall the mismatch-framed information relates to changes in physical activity and dietary behaviour.

Limitations

The transferability of findings from this study is limited by the fairly homogeneous sample, which comprised mostly white, well-educated individuals. Participants were self-selected, so had a prior interest in health, which may have led them to find the resources more interesting and engaging than people who have little interest in health. However, all the participants reported being overweight and/or inactive, and developing interventions for this group is still a useful effort. Future work should assess whether the mismatch concept is interesting and understandable for people who are not particularly interested in their health but who currently lead unhealthy lives. The interview context in which the resources were viewed by participants is unlikely to reflect a real-life situation, where individuals choose what they attend to and what they ignore, and conclusions cannot be drawn about whether people would choose to start reading the resources of their own accord. There may also have been a social desirability bias, with participants being less likely to provide very negative feedback. However, it was not made known to participants that the researcher had written/designed the resources and all questions were neutrally framed in order to gain both positive and negative responses.

Conclusion

Using the concept of an evolutionary mismatch to frame health information about diet and physical activity helped to generate interest in information resources. The mismatch concept also seemed to strengthen the perceived rationale for behaviour change. Future work is needed to find ways to overcome potential reactance and negative elaboration from mismatch-framed health messages, while still capitalising on the facilitating factors that the mismatch concept can bring to communicating health information. By promoting interest in health information, the mismatch concept may help to increase engagement with health

promotion interventions.

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Table 1. Study resources

Resource	**Type and number of resources**	**Description**
Graphics	Initial interest-generating (N = 4)	Professionally designed; sought to convey the mismatch concept in an eye-catching, quickly understandable way (like a campaign poster).
	Illustrative (N = 8)	Designed by the researchers; comprised simple pictures and diagrams. Four of these conveyed physical activity-related concepts (e.g. effects of historic and modern day activities on the body, importance of muscle in glucose metabolism). Another four conveyed diet-related concepts (e.g. comparison of historic and modern diets, evolved defence mechanisms of fat).
Expository texts	(N = 3)	One introductory text conveyed the mismatch concept; one discussed physical activity, highlighting changes in the types and amount of human habitual physical activity through history, focusing on the roles of muscle and fat in glucose metabolism; one text covered diet, with a focus on evolved taste preferences, fat storage and how leptin affects weight-loss attempts. All included tips about making behaviour changes.
Narratives	(N = 2)	Written from the perspective of individuals who had been diagnosed as at high risk of developing diabetes. One concerned a male character who tried to increase his activity levels. One concerned a female character who tried to improve her diet. Both characters discussed reading the mismatch resources and how they had used the information to make small changes to their lifestyles. The narratives were based on commonly cited reasons for not adopting healthier behaviours and popular beliefs regarding physical activity and diet (Roberts and Marvin, 2011).

Table 2. Descriptive details of participants

Participant	Group	Age	Gender	BMI	Employment	Education
P1	Diet	37	F	34	FT - office	postgraduate
P2	Diet	53	M	24	PT - office	postgraduate
P3	Diet	38	F	26	PT - office	undergraduate
P4	Diet	43	F	31	PT - office	undergraduate
P5	Diet	35	F	27	PT - office	undergraduate
P6	Diet	58	M	26	FT - office	postgraduate
P7	Diet	65	F	22	Retired	NVQ
P8	Diet	61	M	31	PT - office	postgraduate
P9	Diet	39	F	22	PT - office	undergraduate
P10	PA	46	M	28	FT - office	postgraduate
P11	PA	61	F	31	Retired	undergraduate
P12	PA	61	F	27	Retired	postgraduate
P13	PA	51	F	24	PT - office	undergraduate
P14	PA	67	M	27	Retired	A-level
P15	PA	42	F	24	PT - office	postgraduate
P16	PA	47	M	30	FT - manual	GCSE
P17	PA	74	M	34	Retired	undergraduate
P18	PA	37	F	24	PT - office	postgraduate

FT = full time, PT = part time, PA = physical activity